GIS Approach for Monitoring and Evaluating Endoparasitc (Phorid fly – *Pseudacteon* spp.) Biological Control Agent Releases and Spread in Imported Fire Ant, *Solenopsis* spp., Populations

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Project Summary

USDA (United States Department of Agriculture), APHIS (Animal Plant Health Inspection Service), CPHST (Center for Plant Health Science Technology) are allocating significant funding to the rearing and distribution of phorid flies to state and federal collaborators for releases in IFA (Imported Fire Ant) infested states. Spatially explicit factors assumed to affect successful phorid fly releases and establishment include; habitat type, land use, water sources, wind barriers, previous treatment strategies (poison bait applications), IFA population densities, and ant social forms (monogyne vs. polygyne). GIS (Geographic Information Systems) is a dynamic tool that can organize and compile these factors into an integrated program. This approach can be of immense value in targeting areas for efficient and effective phorid fly releases.

There are two related components to this GIS project; 1) a phorid fly tracking program, and 2) a predictive decision and management support program. The tracking component of the project is being initiated in 2003-2004 of the multi-year project. The tracking program uses GIS technology to display and organize information on IFA and phorid fly data (Figure 1). The modeling component will be developed as a decision and management system using data generated from the tracking component.

Figure 1. Data layers in ARCGIS 8.3

Field Site Data

- •Field ID (msharrison0001)
- •State (list)
- •County
- •Status (active or removed)
- •Releases (yes or no)
- •Previous Insecticide Use (yes or no)
- •Land Use (list)
- •Soil Type (list)
- •Permanent Visible Water Source (yes or no)
- •Visible Windbreak (yes or no)
- •Latitude
- •Longitude
- •Comments

1 GPS point (field entry)

Fly Release Data

- *Field ID
- •Date (list)
  - •Begin
  - •End
- •Observer
- •Fly Source (list)
  - •APHIS
  - •Other
- •Release Method (list)
  - •Attack box
  - •Open mound
  - •Other
- •Fly Species (list)
  - •P. tricuspus
  - •P. curvatus
  - •Etc.
- • # Flies Released
- • # Mounds Introduced
- •Release Temperature (list)
  - •Soil (average)
  - •Air (average)
- •Weather Conditions (list)
  - •Cloudy
  - •Sunny
  - •Partially cloudy
  - •Rainy
  - •Windy
  - •Other
- •Latitude
- •Longitude
- •Comments

1 GPS point (in field)

Fire Ant Data

- *Field ID
- •Date
- •Time
- •Observer
- •Sample Method (list)
  - •Circle (1/4 acre)
  - •Trans-4 arm
  - •Trans-linear
- •Ant Species (list)
  - •Red monogyne
  - •Red polygyne
  - •Black
  - •Hybrid
  - •Unknown
- • # active mounds rank 1
- • # active mounds rank 2
- • # active mounds rank 3
- • # active mounds rank 4
- • # active mounds rank 5
- •Latitude
- •Longitude
- •Comments

3 GPS points (1 per sampling area)

Fly Monitoring Data

- *Field ID
- •Date
- •Time
- •Observer
- •# Flies Observed
- •Latitude
- •Longitude
- •Comments

10 GPS points (1 for each mound sampled)

Goals and Anticipated Uses

This GIS program is being designed as a tool and modeling program that collaborators can use to monitor and evaluate releases, establishments, and spread of phorid flies in IFA populations, within states. To meet this goal, geo-referenced data in and around phorid fly release sites are compiled and systematically integrated into the GIS program. The value of a GIS decision and management system is its ability to realistically capture targeted response variables. The response variables in this GIS program are predictions of where phorid fly releases are likely to be established, and where phorid fly populations are likely to spread. A model verification and validation procedure will be used to rigorously test and evaluate program performance.

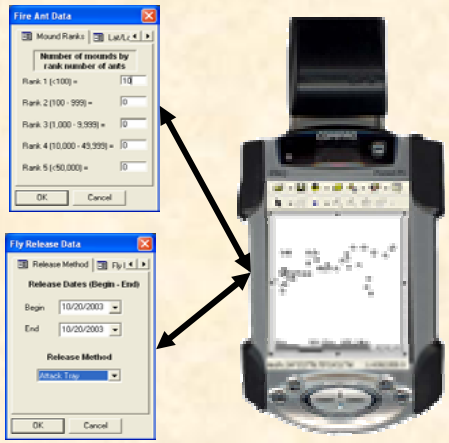
For this GIS program to be useful and accessible, a user friendly interface will be developed. The interface will provide end-users (e.g. state and federal collaborators) the ability to query the GIS database for previous release sites, monitor the spread of previous releases, enter new data, and generate reports and maps. A website for this project has been developed and is available at http://www.cphst.org/pages/monitoring.

Data Collection and Management

Spatial data are collected using a GPS (Teletype WorldNavigator® Global Positioning System) attached to an iPAQ® Pocket PC H3955 (Figure 2). Additional iPAQ® hardware includes an iPAQ® Expansion Pack Plus® and 256MB SecureDigital® Card. Users "check-out" and "borrow" the GPS/Pocket PC equipment for a period of time (ca. 2 weeks) for fly and ant data collection and then return the equipment to the SIPL (Soil Inhabiting Pests Laboratory) for data downloading and maintenance.

Data are entered into GPS/Pocket PC units via customized application forms (Figure 2) running in ARCPAD 6 (ESRI®). Application forms were designed using ARCPAD Application Builder 6 (ESRI®). Data are maintained using ARCGIS 8.3 (ESRI®) software on a Dell® Precision 650 Workstation computer in Gulfport, MS at the Soil Inhabiting Pests Laboratory http://www.cphst.org/pages/IFASIPL.

Figure 2. GPS/Pocket PC running ARCPAD application forms*



***Accessories and Qualifying Statement**

Additional equipment and accessories may include: Activesync Microsoft® software, USB Charge/Sync Cable iPaq® and Rugged Case for iPaq®.

Note: Mention of trade names or proprietary products does not constitute an endorsement or recommendation for use by the U.S. Department of Agriculture.

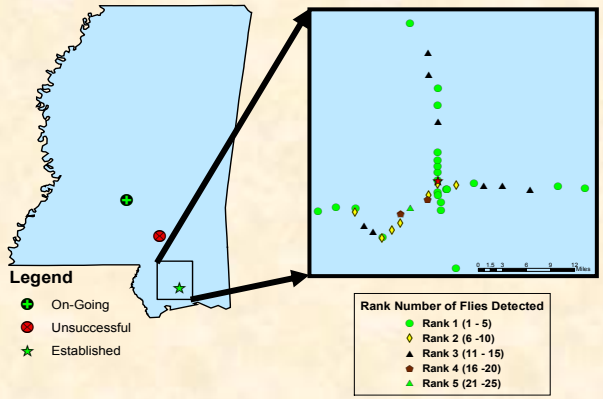
Maps of Phorid Fly Releases, Establishments, and Spread

Phorid flies have been released in 11 states (Map 1) and Puerto Rico. Data from a recent survey conducted in Mississippi are presented in Map 2. The survey was conducted over a two week period in October 2003 along an east – west and north – south transect. Flies were detected up to ca. 20 miles from an initial release (2000) location near Saucier, MS (Map 2, expanded view). Another release (2002) in Hattiesberg, MS, has failed to show any evidence of fly establishment. In Mississippi, survey results show that the flies have become well established and are spreading in the southern end of the state (Map 2).

Map 1. Phorid Releases in U.S. (Courtesy of Dr. Sanford Porter et al.)

Map 2. Survey results from APHIS releases in Mississippi (2003 data)*

* Rank infestation levels of flies are based on total number of flies detected in 10 mounds sampled at each point location.



Future Direction and Linkages

Currently, only one phorid fly species has been released in the APHIS release program, *Pseudacteon tricuspus*. As more proposed species are released, this CPHST program will provide regulatory officials a tool to monitor multiple phorid species releases, establishments, and spread. This GIS-Phorid program is structured to enable future linkage with other IFA control strategies or biological control agents, which would allow for estimation of their impact on IFA populations under different management scenarios.

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